

Claims

1. A method of producing a magnetic recording medium comprising a step of forming successively a nonmagnetic substrate, a metal underlayer and a ferromagnetic metal layer in a multilayer wherein
the step of forming said ferromagnetic metal layer is a step of forming alternately a plurality of ferromagnetic films and one or more nonmagnetic metal spacer layer or layers in a multilayer, and comprising
a step of allowing at least the interface of said nonmagnetic metal spacer layer or layers to adsorb physically oxygen and/or nitrogen.
2. The method of producing the magnetic recording medium according to claim 1 wherein said nonmagnetic metal spacer layer or layers is or are formed in such a way that said oxygen and/or nitrogen may be contained in the film of the nonmagnetic metal spacer layer or layers.
3. The method of producing the magnetic recording medium according to claim 1 or 2 wherein the gas used for forming said nonmagnetic metal spacer layer or layers is a mixed gas obtained by mixing oxygen or nitrogen with Ar or other rare gases.
4. The method of producing the magnetic recording medium according to claim 3 wherein the partial pressure of oxygen or nitrogen contained in such mixed gas is set at 10^{-7} Torr or above and 10^{-3} Torr or below.
5. The method of producing the magnetic recording medium according to claim 4 wherein the partial pressure of oxygen or nitrogen contained in such mixed gas is set at 3×10^{-6} Torr or above and 3×10^{-5} Torr or below.
6. The method of producing the magnetic recording medium according to any one of claims 1 – 5 wherein the step of allowing at least the interface of said nonmagnetic metal spacer layer or layers to adsorb physically oxygen and or nitrogen is a step of exposing the surface of said nonmagnetic metal spacer layer or layers to an atmosphere containing oxygen and/or nitrogen.
7. The method of producing the magnetic recording medium according to claim 6 wherein the exposure of the surface of said nonmagnetic metal spacer layer or layers to oxygen is set at 10 Langmuir or more.
8. The method of producing the magnetic recording medium according to any one of claims 1 – 7 wherein a metal film containing a kind or more of element or elements chosen from Ru, Ir, Cu and Os for said nonmagnetic metal spacer layer or layers is formed.

9. The method of producing the magnetic recording medium according to any one of claims 1 – 8 wherein the thickness of said nonmagnetic metal spacer layer or layers is set at 0.5 nm or more and 1.0 nm or below.

10. A magnetic recording medium comprising a nonmagnetic substrate, a metal underlayer and a ferromagnetic metal layer formed successively in a layer, wherein

said ferromagnetic metal layer comprises a plurality of ferromagnetic films and one or more nonmagnetic metal spacer layer or layers formed between said ferromagnetic films, and

the exchange bias field H_{ex} of said ferromagnetic metal layer is set at 1,000 Oe or above.

11. The magnetic recording medium according to claim 10 wherein the exchange bias field H_{ex} of said ferromagnetic metal layer is set at 1,500 Oe or above.

12. A magnetic recording medium comprising a nonmagnetic substrate, a metal underlayer and a ferromagnetic metal layer formed successively in a layer, wherein

said ferromagnetic metal layer comprises a plurality of ferromagnetic films and one or more nonmagnetic metal spacer layer or layers formed between said ferromagnetic films,

said nonmagnetic metal spacer layer or layers is or are a metal film or films containing one kind or more of element or elements chosen from Ru, Ir, Cu and Os, and

oxygen and/or nitrogen is or are physically absorbed at least at the interface between said nonmagnetic spacer layer or layers and said ferromagnetic films.

13. The magnetic recording medium according to any one of claims 10 – 12 wherein the thickness of said nonmagnetic metal spacer layer or layers is set at 0.5 nm or above and 1.0 nm or below.

14. A magnetic recording apparatus comprising a magnetic recording medium according to any one of claims 10 – 13, a driving part for driving said magnetic recording medium and a magnetic head for recording and reproducing magnetic information, wherein said magnetic head records and reproduces magnetic information on and from said moving magnetic recording medium.

(Caption)

Fig. 4. After impression of 14 kOe